

Before the Federal Communications Commission, Washington, DC	
In the Matter of: Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems	CC Docket No. 94-102 RM-8143 FCC 01-175
Comments on: Further Notice of Proposed Rulemaking (released May 25, 2001)	"Non-service initialized mobile wireless phones"
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Comments on FCC FNPRM on Callback for 'Noninitialized Phones'

Cellular Networking Perspectives Ltd. hereby provides comments on the FCC FNPRM (Further Notice of Proposed Rulemaking) identified above, related to callback for 'noninitialized phones'. Employees of our company have been involved in the development of technical standards for Enhanced Wireless 9-1-1 since 1994, representing various clients in the wireless industry. We also publish the technical bulletin "Cellular Networking Perspectives", which has published several articles describing various technical aspects of Enhanced 911. David Crowe, the company president, has also written articles for "Wireless Review" magazine on topics related to wireless emergency services. He is also the editor of joint TIA/ATIS T1 standard J-STD-036 and was a participant in the development of J-STD-034.

Caveats

Cellular Networking Perspectives Ltd. is a Canadian company and therefore has no direct interest in US government policy on enhanced 9-1-1, nor are we representing a specific US-based company through these comments. However, we are very familiar with technical issues of Enhanced 911, and although our comments are focused on technical issues, we feel that it is appropriate to point out policy implications of various technical solutions where they arise.

Definitions

We feel that the term ‘unsubscribed wireless phones’ is more technically correct than ‘non-service-initialized’ or ‘noninitialized’ which is used throughout the NPRM. Often, these phones *have* been initialized. In fact, previously initialized, but currently unsubscribed, phones are a bigger problem than those that have never been initialized.

Responsibility for Technical E911 Solutions

Since 1994, TIA subcommittee TR-45.2 and ATIS T1P1 have been developing technical solutions for Wireless E911. Some of this work was presented to the FCC by the WEIAD in a joint CTIA, PCIA, APCO, NENA, NASNA, Ad Hoc Alliance for Public Access to 911 filing in 1998. The accomplishments of TR-45.2 and T1P1 include:

- Publication of joint TIA/T1 standards J-STD-034 (E911 Phase I) and J-STD-036 (E911 Phase II),
- Working with public safety (specifically with public safety representatives present at most meetings),
- Efforts to achieve technical compliance with the FCC wireless enhanced 911 mandate (94-102), and
- Consideration of public safety requirements beyond the 94-102 mandate.

Examples of capabilities that go beyond the FCC E911 mandate that are standardized in J-STD-034 or J-STD-036 are:

- E911 Reconnect, allowing automatic re-paging of a wireless phone that is disconnected due to a radio problem. This is different from callback, as it is done automatically by wireless systems and does not involve PSAP participation.
- Support for 9-1-1 calls established as a 3-way call following an inter-system handoff.
- Specification of Emergency Services Routing Key (ESRK) as a way to indirectly communicate information about a wireless call to a PSAP, as opposed to the Mobile Directory Number/ESRD method recommended in J-STD-034.
- Support for TCP/IP as a network interface, for the convenience of public safety, as opposed to SS7 which is the preferred interface for telecommunications signaling.

This technical standards work has been ignored by the FNPRM. This is in contrast to the CALEA mandate, where the work of ATIS T1 and TIA TR-45.2 was recognized, in particular the significance of J-STD-025, even though the FCC clearly did not agree with everything in this standard.

The FCC may wish to consider a similar system for the E911 mandate, where technical work based on the mandate is performed by industry-wide, open technical committees (e.g. TIA TR-45.2 and ATIS T1P1), with the FCC exercising a regulatory/oversight role. If this direction was taken, the only change required would be for the recognized industry group to report to the FCC on progress in areas such as E911 callback, allowing the FCC to intervene only if it becomes clear that the industry effort is inadequate, biased or needs to be given direction through new or modified rules or regulations.

Callback: The Impossible Dream?

Callback can never work in every case, not even for subscribed mobiles. Some of the situations that can cause callback to fail for subscribed mobiles, particularly when roaming, are:

- Call forwarding.
- Disabled call delivery (quite likely for prepaid phones).
- International mobiles, when PSAP policy, funding restrictions or lack of training does not allow personnel to recognize and make calls back to an international number.
- Use of a control channel in a non-preferred system (e.g. due to lack of coverage by a preferred carrier), which may allow 9-1-1 calls to be made by all mobiles, but which can only register mobiles roaming from a system with which it has a business agreement.
- Busy mobile (which does not have call waiting, or already has a call waiting)
- Mobile outside coverage area that can provide it with service.
- Mobile turned off or out of power.

Lack of Distinction between MDN and MIN

It is critical when discussing callback to distinguish between the MDN (Mobile Directory Number) and MIN (Mobile Identification Number), particularly when considering the impact of the FCC LNP (Local Number Portability) mandate. This distinction was *not* made in the FNPRM.

The MDN is the number that is dialed to reach a phone. During callback, the PSAP will dial the MDN. MDN's are variable in length, with 7, 10 or 11 digits being dialed depending on the relative location of the caller (the PSAP) and the home system for the mobile. For international mobiles making an emergency call in the United States, even more digits might be required for callback.

The MIN is the number that is used to uniquely identify a phone over a compatible radio interface (AMPS, N-AMPS, D-AMPS, CDMA). It is fixed in length, always being 10 digits long. When a phone originates an emergency call, it transmits its MIN, not its MDN.

This confusion is understandable because for most US wireless phones the MIN is the same as the (10 digit form of) MDN. However, this is *not* the case for:

- International mobiles, which are increasingly programmed with an IRM as MIN (first digit 0 or 1). Occasionally, they are programmed with phone numbers from their home country (e.g. Mexican mobiles used to be programmed as 52xxxxxxx, where "52" is the Mexican country code) that may match a dialable number of a North American phone.
- Data terminals from companies like Aeris, Cellemetry and UPS.
- Ported or Pooled wireless phones.
- (in the future) Wireless phones after an area code change.

- Phones with multiple MDN's.
- Phones using GSM, or other standards that support IMSI. IMSI performs the same function as MIN but is never aligned with the MDN.

The importance of this distinction cannot be overemphasized. There is only one network element that can always map between the MIN received during origination of a call and the MDN, and that is the home system (HLR). For wireless systems that support TIA/EIA/IS-41 Revision C or TIA/EIA-41-D (or later), this capability can also be performed at the current serving system (e.g. the system where the call is being made) when a mobile is roaming.

It is clearly not just the FCC that is confused about the distinction between MIN and MDN (and its importance). An emergency phone manufacturer that programs the same MIN in every phone (e.g. Magnavox according to the FCC), for example, is wrong on two counts:

- The MIN will *not* be transmitted to the Emergency Services Network if J-STD-036 or J-STD-034 is correctly implemented, at least not on systems that support IS-41-C or beyond.
- The phone may not be able to make a call at all if there is another phone with the same MIN in the same cellsite, due to technical limitations of the radio interfaces (which need a unique identifier to assign a traffic channel to the mobile).

Solution 1: Free Subscriptions

One solution to the MIN/MDN translation problem is to insist that wireless carriers provide a free subscription to everyone with a cellular phone. On a small scale, this solution has apparently already been chosen by some wireless carriers when donating phones that are intended only for emergency use. However, there are a number of problems with this solution, including some policy questions:

- Carriers would be forced to absorb the cost of maintaining the subscription, including contacting the free subscriber regularly to ensure that numbers for phones that have been removed from circulation are reclaimed. Not to do this would possibly violate FCC number conservation requirements.
- Analog carriers could be forced to absorb much greater costs, because the bulk of older phones used as *ad hoc* emergency phones are likely to be analog models sold cheaply or given away by subscribers purchasing newer digital models.
- Carriers would be forced to perform location tracking for these phones in order to ensure that their location is known at the time of callback. This could result in a significant use of radio and network signaling resources.
- The FCC must decide whether these 'free' subscriptions are also exempt from various 911 surcharges. If they are not exempt carriers will now have an additional cost of performing billing and collection, which will introduce costs that are probably far higher than the revenue received (which will not go to the wireless carrier under current rules).
- Wireless carriers could not prevent the termination of calls to these mobiles, having no way to determine the source of callback. If this problem is not resolved, phones

with free subscriptions could be used to receive free calls from any source. This has the potential for causing huge financial losses for carriers.

Solution 2: Temporary Subscriptions

The TLDN (Temporary Local Directory Number) solution mentioned in the FNPRM is equivalent to a temporary subscription. A directory number is assigned to a mobile for a period of time, and can be used for callback. This solution was considered by TIA TR-45.2, and was rejected, because it is a complex and, at best, incomplete solution. Some of the deficiencies are:

- Enough TLDN's must be available to accommodate the maximum number of unsubscribed E911 calls that can realistically be made *within the time period within which callback is allowed*. This is significantly different from TLDN's used for call delivery, where each TLDN is assigned to a call to a roamer only for the time it takes to set up a call. Even in failure situations, a TLDN used for call delivery can be reassigned within a few seconds.
- The maximum length of time that callback is allowed must be defined. For example, if callback is allowed within a 24 hour period, every TLDN must be assigned for this time period. Which organization will define this – the FCC, public safety, the wireless industry as a whole, or individual wireless carriers?
- Callback to the wrong mobile is possible if performed after the TLDN is reassigned.
- Callback is still not possible to phones without unique MIN codes.
- Callback is not possible if the phone moves outside the coverage area of the system where the emergency call was made.

Solution 3: Roamer Ports

Another potential solution that was considered by TIA TR-45.2 and rejected (with the blessing of public safety) was the use of the roamer port. This allows a phone without an MDN to receive a call. However, it has a number of problems:

- The PSAP will have to maintain a database of roamer port phone numbers based on the identity of the wireless system sending it an emergency call.
- Because of this, callback to phones that have moved to another system would not be possible.
- Roamer ports require complicated two-stage dialing, which is not easily automated.
- IS-41-C and TIA/EIA-41-D have redefined the Roamer Port to use the MDN, not the MIN, which means that callback to phones without a unique MDN would still not be possible.
- Callback to phones without a unique MIN will still be unreliable.
- Some carriers are eliminating roamer ports because they are a potential source of prepaid fraud (i.e. free terminations).

Problems Created by Public Safety & the FCC

Issues that were conspicuously not addressed by the FNPRM are callback problems created by the FCC and Public Safety themselves. The acceptance of limitations on callback in these cases is perhaps an indication that the FCC and Public Safety recognize that callback will always be a tradeoff between multiple complex technical, cost and public policy issues.

FCC LNP Mandate

The FCC LNP mandate forces the separation of MIN and MDN. However, wireless systems in areas not specified in the LNP mandate, which are using IS-41 Revision A or B for mobility management (call delivery to roamers, etc.) will not be able to provide callback for ported wireless phones. These systems do not have access to the MDN and must assume that the MDN is the same as the MIN. Consequently, for a ported wireless phone, they will likely provide the MIN to the PSAP, resulting in a failure of callback or, worse yet, callback to the wrong mobile.

FCC Number Conservation Mandate

Several potential solutions to the callback problem could result in the stranding of numbers:

- Use of a TLDN pool for this purpose will result in many more numbers being assigned to this purpose than will ever be used. Both the number of simultaneous calls from unsubscribed phones and the maximum duration between making a 9-1-1 call and being called back must be worst-case estimates, possibly resulting in much larger pools of TLDN's than for call delivery, even though these numbers are used all the time for call delivery to roamers. Will conflicts between these FCC mandates result a minimum size on this pool imposed by the E911 mandate and penalization of carriers for underutilization of these rarely-used numbers based on the number conservation mandate?
- Assignment of a permanent directory number for emergency-only phones could result in many more stranded numbers. Unless carriers put considerable cost and effort into tracking address changes and permanent removal from service of mobiles, numbers will be assigned to phones which could not be used for any purpose (e.g. because they have broken down or been discarded).

Public Safety Preference for ESRK versus ESRD

J-STD-034 recommended that wireless systems transmit two digit strings to the 911 tandem/Selective Router – MDN in the ANI field and ESRD (Emergency Service Routing Digits) as dialed digits. These identifiers were chosen because they fulfilled a number of purposes:

- Identifying the caller (MDN – Mobile Directory Number)
- Allowing callback with a reasonable chance of completion (MDN, although there are a number of reasons why callback might fail, including call forwarding)
- Identifying the cellsite or sector from which the call originated (ESRD)

- Allowing routing through a standard telephone switch (ESRD, but only if assigned by PSAP and not wireless carrier)

J-STD-034 therefore provided a simple means of achieving the FCC Phase I E911 mandate when only an MF signaling ('analog') trunk connection was available. This solution is perfectly compatible with Phase II solutions in J-STD-036.

However, public safety has preferred another solution - ESRK (Emergency Services Routing Key) instead. This is a TLDN-like number that is assigned for the duration of an E911 call. The ESRK, by itself, conveys very little information (only the identity of the wireless carrier). However, by simultaneously recording information in a modified ALI database, the information that the ESRD and MDN supplies can be made available.

PSAP's may prefer this solution because it can be implemented by a third party with no changes to their equipment. The ESRD/MDN signaling solution requires advancing beyond the CAMA signaling interfaces that only transmit one useful string of digits.

However, by choosing this type of interface, PSAP's have increased the chance of callback *not* being available. If there is any failure of the ALI database equipment, or of the wireless or emergency services interface to the ALI, none of the Phase I information will be available. In failure situations like this, callback will be unavailable to unsubscribed and subscriber emergency callers alike.

The preference for ESRK indicates clearly that PSAP's realize that there are potentially enormous costs to making callback available to every emergency caller at every point in time.

Recommendations

The FCC should consider the following recommendations:

- Take no action on the FNPRM.
- Monitor the activities of technical committees such as TIA TR-45.2 and ATIS T1P1 and only change technical requirements when it is clear that the committees cannot complete their work inside the current mandate or when it is clear that the work of the committee does not reflect a good balance of industry needs and public safety requirements.